May 28, 2004

Mr. Michael Kansler
President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION - EXTENDED POWER UPRATE, VERMONT YANKEE NUCLEAR POWER STATION (TAC NO. MC0761)

Dear Mr. Kansler:

By letter dated September 10, 2003, as supplemented on October 1, 2003, October 28, 2003 (2 letters), January 31, 2004 (2 letters), March 4, 2004, and May 19, 2004, Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc., submitted a proposed license amendment to the U.S. Nuclear Regulatory Commission (NRC) for the Vermont Yankee Nuclear Power Station (VYNPS). The proposed amendment, "Technical Specification Proposed Change No. 263, Extended Power Uprate" would allow an increase in the maximum authorized power level for VYNPS from 1593 megawatts thermal (MWT) to 1912 MWT.

The NRC staff is reviewing your submittal and has determined that additional information is required to complete the review. The specific information requested is addressed in the enclosure. Please note that several of the questions in this request relate to steam dryer integrity. Recent steam dryer cracking issues at another facility highlight the significance of this issue because of the potential for parts to break loose and impact the performance of safety-related equipment. Accordingly, the NRC needs to fully understand the analysis, design, and monitoring that Entergy plans for the VYNPS steam dryer as part of our evaluation of your request to operate at a higher power level.

We request that the additional information be provided by June 30, 2004. The response timeframe was discussed with Ms. Ronda Daflucas of your staff on May 25, 2004. If circumstances result in the need to revise your response date, or if you have any questions, please contact me at (301) 415-1420.

Sincerely,

/RA/

Richard B. Ennis, Senior Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-271

Enclosure: As stated

cc w/encl: See next page

May 28, 2004

Mr. Michael Kansler
President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION - EXTENDED POWER UPRATE, VERMONT YANKEE NUCLEAR POWER STATION (TAC NO. MC0761)

Dear Mr. Kansler:

By letter dated September 10, 2003, as supplemented on October 1, 2003, October 28, 2003 (2 letters), January 31, 2004 (2 letters), March 4, 2004, and May 19, 2004, Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc., submitted a proposed license amendment to the U.S. Nuclear Regulatory Commission (NRC) for the Vermont Yankee Nuclear Power Station (VYNPS). The proposed amendment, "Technical Specification Proposed Change No. 263, Extended Power Uprate" would allow an increase in the maximum authorized power level for VYNPS from 1593 megawatts thermal (MWT) to 1912 MWT.

The NRC staff is reviewing your submittal and has determined that additional information is required to complete the review. The specific information requested is addressed in the enclosure. Please note that several of the questions in this request relate to steam dryer integrity. Recent steam dryer cracking issues at another facility highlight the significance of this issue because of the potential for parts to break loose and impact the performance of safety-related equipment. Accordingly, the NRC needs to fully understand the analysis, design, and monitoring that Entergy plans for the VYNPS steam dryer as part of our evaluation of your request to operate at a higher power level.

We request that the additional information be provided by June 30, 2004. The response timeframe was discussed with Ms. Ronda Daflucas of your staff on May 25, 2004. If circumstances result in the need to revise your response date, or if you have any questions, please contact me at (301) 415-1420.

Sincerely,

/RA/

Richard B. Ennis, Senior Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-271
Enclosure: As stated
cc w/encl: See next page

<u>DISTRIBUTION</u>:

PUBLIC	TChan, EMCB-B	JCai, IROB-B	HWalker, SPSB-C
PDI-2 Reading	RDavis, EMCB-B	JBongarra, IROB-B	MHart, SPSB-C
AHowe	LLund, EMCB-C	JTappert, RLEP-C	FAkstulewicz, SRXB-A
REnnis	KParczewski, EMCB-C	SImboden, RLEP-C	EKendrick, SRXB-A
AMcMurtray	KManoly, EMEB-B	JYerokun, SPLB-A	
CAnderson, RGN I	CWu, EMEB-B	DReddy, SPLB-A	
EMarinos, EEIB-A	DThatcher, IPSB-A	SWeerakkody, SPLB-B	
HGarg, EEIB-A	RPettis, IPSB-A	RGallucci, SPLB-B	
RJenkins, EEIB-B	KCoyne, IPSB-A	MRubin, SPSB-A	
NTrehan, EEIB-B	SKlementowicz, IPSB-B	MStutzke, SPSB-A	
MMitchell, EMCB-A	RPedersen, IPSB-B	RDennig, SPSB-C	
BElliot, EMCB-A	DTrimble, IROB-B	RLobel, SPSB-C	

ACCESSION NO.: ML041450020 * See previous concurrence

OFFICE	PDI-2/PM	EMCB-A/SC(A)*	EMEB-B/SC*	RLEP-C/SC*	IPSB-B/SC*
NAME	REnnis	ALee for MMitchell	KManoly	JTappert	DThatcher
DATE	5/27/04	5/24/04	5/24/04	5/24/04	5/25/04

OFFICE	SPLB-A/SC(A)*	SPSB-C/SC*	SRXB-A/SC*	PDI-VY/SC
NAME	JYerokun	RDennig	RLandry for FAkstulewicz	AHowe
DATE	5/24/04	5/24/04	5/24/04	5/27/04

OFFICIAL RECORD COPY

cc:

Regional Administrator, Region I
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406-1415

Mr. David R. Lewis
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N.W.
Washington, DC 20037-1128

Ms. Christine S. Salembier, Commissioner
Vermont Department of Public Service
112 State Street
Montpelier, VT 05620-2601

Mr. Michael H. Dworkin, Chairman
Public Service Board
State of Vermont
112 State Street
Montpelier, VT 05620-2701

Chairman, Board of Selectmen
Town of Vernon
P.O. Box 116
Vernon, VT 05354-0116

Operating Experience Coordinator
Vermont Yankee Nuclear Power Station
320 Governor Hunt Road
Vernon, VT 05354

G. Dana Bisbee, Esq.
Deputy Attorney General
33 Capitol Street
Concord, NH 03301-6937

Chief, Safety Unit
Office of the Attorney General
One Ashburton Place, 19th Floor
Boston, MA 02108

Ms. Deborah B. Katz
Box 83
Shelburne Falls, MA 01370

Ms. Carla A. White, RRPT, CHP
Radiological Health
Vermont Department of Health
P.O. Box 70, Drawer #43
108 Cherry Street
Burlington, VT 05402-0070

Mr. James M. DeVincentis
Manager, Licensing
Vermont Yankee Nuclear Power Station
P.O. Box 0500
185 Old Ferry Road
Brattleboro, VT 05302-0500

Resident Inspector
Vermont Yankee Nuclear Power Station
U. S. Nuclear Regulatory Commission
P.O. Box 176
Vernon, VT 05354

Director, Massachusetts Emergency
Management Agency
ATTN: James Muckerheide
400 Worcester Rd.
Framingham, MA 01702-5399

Jonathan M. Block, Esq.
Main Street
P.O. Box 566
Putney, VT 05346-0566

Mr. John F. McCann
Director, Nuclear Safety Assurance
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

Mr. Gary J. Taylor
Chief Executive Officer
Entergy Operations
1340 Echelon Parkway
Jackson, MS 39213

cc:

Mr. John T. Herron
Sr. VP and Chief Operating Officer
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

Mr. Danny L. Pace
Vice President, Engineering
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

Mr. Brian O'Grady
Vice President, Operations Support
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

Mr. Michael J. Colomb
Director of Oversight
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

Mr. John M. Fulton
Assistant General Counsel
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

Mr. Jay K. Thayer
Site Vice President
Entergy Nuclear Operations, Inc.
Vermont Yankee Nuclear Power Station
P.O. Box 0500
185 Old Ferry Road
Brattleboro, VT 05302-0500

Mr. Kenneth L. Graesser
38832 N. Ashley Drive
Lake Villa, IL 60046

Mr. James Sniezek
5486 Nithsdale Drive
Salisbury, MD 21801

Mr. Ronald Toole
1282 Valley of Lakes
Box R-10
Hazelton, PA 18202

Ms. Stacey M. Lousteau
Treasury Department
Entergy Services, Inc.
639 Loyola Avenue
New Orleans, LA 70113

Mr. Raymond Shadis
New England Coalition
Post Office Box 98
Edgecomb, ME 04556

Mr. James P. Matteau
Executive Director
Windham Regional Commission
139 Main Street, Suite 505
Brattleboro, VT 05301

Mr. William K. Sherman
Vermont Department of Public Service
112 State Street
Drawer 20
Montpelier, VT 05620-2601

REQUEST FOR ADDITIONAL INFORMATION

REGARDING PROPOSED LICENSE AMENDMENT

EXTENDED POWER UPRATE

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

By letter dated September 10, 2003, as supplemented on October 1, 2003, October 28, 2003 (2 letters), January 31, 2004 (2 letters), March 4, 2004, and May 19, 2004 (References 1 through 8), Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (Entergy or the licensee), submitted a proposed license amendment to the U.S. Nuclear Regulatory Commission (NRC) for the Vermont Yankee Nuclear Power Station (VYNPS). The proposed amendment, “Technical Specification Proposed Change No. 263, Extended Power Uprate” would allow an increase in the maximum authorized power level for VYNPS from 1593 megawatts thermal (MWT) to 1912 MWT.

The NRC staff is reviewing your Extended Power Uprate (EPU) amendment request and has determined that additional information is required to complete the review. The specific information requested is addressed in the following questions:

Enclosure

Materials and Chemical Engineering Branch (EMCB)

<u>Vessels and Internals Integrity and Welding Section (EMCB-A)</u>
Reviewer: Barry Elliot

During the Spring 2004 refueling outage at VYNPS, the licensee identified cracking in the steam dryer. The licensee has repaired some cracks and evaluated others acceptable for return to power at the current licensed thermal power (CLTP) level. The NRC staff requires the following information due to concerns that the proposed EPU conditions could cause the cracks to grow to a size that could effect the integrity of the steam dryer and could cause loose parts.

1. For any detected flaw in the steam dryer left unrepaired, provide a structural integrity evaluation and identify the critical flaw size for EPU conditions and the margins between the critical flaw size and the flaw size projected for the period of time that these flaws will remain inservice. The analysis should consider the potential impact on flaw growth due to the proposed EPU conditions, intergranular stress corrosion cracking (IGSCC) and fatigue. The margins should be compared to those specified in IWB-3600 of Section XI of the American Society of Mechanical Engineers (ASME) Code. An assumed IGSCC crack growth rate should be compared to those specified in NUREG-0313.

2. Provide a plan for future inspections of the steam dryer with justification relating the proposed inspection frequency to the structural integrity analysis provided in response to question 1, above.

Mechanical and Civil Engineering Branch (EMEB)

Civil and Engineering Mechanics Section (EMEB-B)
Reviewer: Cheng-Ih (John) Wu

1. Supplement 4 (Reference 5), Attachment 8, page 26, states that the planned modification of the VYNPS steam dryer includes the replacement of the upper 30-inch section of the original 0.5-inch thick flat vertical hoods (90 degree and 270 degree azimuths), with 1-inch thickness plate. It also states that gussets (33 inches high) are being added between the modified lower dryer cover plates and the unmodified section of the flat vertical dryer hoods. Confirm whether this is the current modified steam dryer installed at VYNPS. If different, describe the actual dryer modification as currently installed at VYNPS. The recent steam dryer failure at Quad Cities Unit 2 (QC2), for this type of design, with gussets attached to the unmodified section of the flat vertical dryer hoods, created stress concentration and cracks at the weld. In light of the failure of a similar modification at QC2, discuss how the steam dryer modification will ensure the structural integrity of the dryer components at VYNPS for the operation at EPU conditions.

2. On April 21, 2004, Entergy briefed the NRC in a conference call with regard to the results of the steam dryer inspection performed during the Spring 2004 outage. Since the steam dryer inspection provides extensive baseline information, the licensee should discuss in detail the cause of each identified crack indication and docket the results of the inspection, including justification of why the results are acceptable with respect to the proposed EPU. It is noted that Quad Cities (QC) did not have a notable dryer failure until after operating at the EPU power level. QC2 has the square type of steam dryer with the internal brace at the outer hood which has failed three times since operating at the EPU power level. The steam dryer at VYNPS is the same design as those at QC. Describe the validation of the steam dryer analysis at VYNPS in successfully predicting steam dryer cracking identified during the Spring 2004 outage.

3. Supplement 4 (Reference 5), Attachment 8, page 6, states that VYNPS plant-specific data for the steam dryer pressure loading is not available. Section 4.1 on this page discusses the overall process developed by General Electric (GE) whereby available steam dryer pressure loading data from other plants has been converted into a reference load distribution versus frequency plot that can be further scaled for plant-specific evaluation use. The reference load definition used detailed pressure versus frequency spectrums taken from in-plant measurements recorded for one domestic and two foreign GE boiling water reactor (BWR) plants. As discussed on page 41 of GE report GENE-0000-0018-3359-NP, “Technical Assessment, Quad Cites Unit 2, Steam Dryer Failure - Determination of Root Cause and Extent of Condition,” dated August 2003 (ADAMS Accession No. ML032340379), at the domestic plant, the pressure was measured in the middle of the cover plates of the outer bank hood in the 90 degree and 270 degree azimuth. In the two foreign reactors, the pressure sensors were located below the dryer ring, on the skirt and drain channels. For the QC2 event, it was considered more appropriate to use the pressure measurements from the domestic plant since the pressure measurement location was in the region of interest. Based on

the lessons-learned from QC2, provide justification for the applicability of the pressure data used for the VYNPS plant-specific application.

4. Describe the manner in which the steam dryer analyses at VYNPS avoids the weaknesses in the steam dryer analyses applied at QC that lead to the catastrophic failures of the steam dryers at the QC units. Describe the validation of the VYNPS steam dryer analyses to accurately predict the hydrodynamic loading at specific locations of the steam dryer. Describe the structural evaluation of the steam dryer at VYNPS to successfully withstand the hydrodynamic loading under EPU conditions.

5. Supplement 4 (Reference 5), Attachment 8, page 6, states that laboratory scale model test measurements were used to develop multipliers to adjust the plant signal readings from the plant measurement location to arrive at an effective pressure at the dryer vertical face. Provide a detailed description of the scale model testing, including how the dryer loading was simulated and the results that justify the correlation of pressure values for different parts of the dryer. Confirm whether the test report has been submitted to the NRC and reviewed by the staff. If not, provide the scale model test report as part of the VYNPS EPU submittal.

6. Supplement 4 (Reference 5), Attachment 8, page 18, Items 1 through 3 provide key assumptions used in developing the steam dryer fluctuating loads based on qualitative observation of measured plant data for several GE BWRs. The acoustic peak maximum amplitudes and frequencies of the acoustic peaks were assumed to be representative of all BWRs. It was also assumed that the maximum pressure amplitudes are related to the steam line flow velocity. Item 4 on this page states that the plant-specific scaling of the fluctuating loads is derived from the assumptions in Items 1, 2, and 3. Attachment 7, page 7, provides equations for determining the plant-specific load amplitude for each frequency zone. Provide information to benchmark the validity of these equations using the existing measured data.

7. Supplement 4 (Reference 5), Attachment 8, page 7, states that the common BWR plant steam piping layout and the resulting similarities in the measured in-plant test data justify the application of the generic load definition to VYNPS. This appears to be in contradiction to the statement on page 148 of GE report GENE-0000-0018-3359-NP (see question 3) which states that the main steam lines and equalizing headers for different plants may have different as-built dimensions which could result in differences in pressure loading on the dryer. Please explain the apparent contradiction.

8. Supplement 4 (Reference 5), Attachment 7, page 7 states that scaling factors were determined for each frequency zone based on plant steam line velocity compared to the reference plant steam velocity. Provide an example to show how the scaling factors were calculated. It appears that the methodology does not address the type of steam dryers used and potential occurrence of the vortex shedding in the region between the dryer and the outlet nozzles. Past operational experience suggests steam dryer with square hoods have a higher frequency of failure than other types of dryers. Provide information to address the dryer geometry effects that cause the failure of the square type of dryers in the BWR plants. The QC2 dryer failures were, in part, due to the vortex shedding between the outlet nozzle and the outer hood. Address why the current evaluation at VYNPS does not include the performance of a computational fluid dynamic

(CFD) analysis, which was previously used by GE to demonstrate the spacial pressure distribution and the reduction of pressure differential.

9. Supplement 4 (Reference 5), Attachment 7, page 8, indicates that the generic load definition and scaling process used for the VYNPS plant-specific application compared well with the loading determined in the QC2 dryer failure root cause evaluation in 2003. In light of the subsequent failure at QC2 in March 2004, your argument does not provide reasonable assurance that the methodology is acceptable. In addition to the assumed acoustic loading, describe the potential flow induced vibration that may occur due to fluid elastic instability, vortex shedding, turbulence, two-phase flow impact, acoustic resonance and the possible fluid-structure interaction.

10. The application dated September 10, 2003 (Reference 1), Attachment 4, Page 3-11, provides information regarding the structural evaluation for the steam dryer. The maximum estimated stresses for the normal operating condition due to flow induced vibration (FIV) are provided in Supplement 4 (Reference 5), Attachment 7, Section 8.3, at the critical dryer locations for the outer cover plates, hood vertical and top plates, hood end and partition plates, and hood bracing gussets. Provide the calculated stresses and cumulative usage factors (CUFs) at the dryer critical locations discussed above and also at the support brackets for the design basis loads such as dead weight, seismic safe shutdown earthquake (SSE) event and the main steam line pipe break at the EPU conditions.

11. The application dated September 10, 2003 (Reference 1), Attachment 6, Table 1-1, “Computer Code used for CPPU [Constant Pressure Power Uprate],” lists ISCOR, LAMB, and TRACG computer codes for computing the reactor internal pressure differences (RIPD) which were used for evaluation of reactor internal components. Specify which of these computer codes were used to calculate RIPD for VYNPS CPPU conditions. Discuss how these computer codes account for the effects of velocities, turbulence and vortex shedding in the regions between the steam dryer and the outlet nozzles while calculating the pressure differential across the dryer. Identify other computer codes that were used in the VYNPS plant-specific evaluation for calculating pressure variations on the reactor internals for CPPU conditions. Confirm whether these computer codes, methodology and models were reviewed and approved by the NRC staff especially for calculating the reactor internal pressure differences. If not, provide technical justification for applicability and acceptance of these computer codes.

12. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 3.4.1, states that the main steam (MS) and feedwater (FW) piping would have increased flow rates and flow velocities in order to accommodate the CPPU. As a result, the MS and FW piping would experience increased vibration levels approximately proportional to the square of the flow velocities. The ASME Code (NB-3622.3) requires that piping be designed and tested under startup or initial service conditions, for ensuring that vibration of piping systems is within acceptable levels. Based on the data provided in Attachment 6, Table 1-2, the vibration may increase as much as 60% of the vibration at the current rated power condition. In light of recent experience with regard to the failures of an electromatic relief valve, small piping failures in MS and FW lines, and FW probe failure during EPU operation in BWR plants, provide evaluations of piping vibration due to increased flow rates at the EPU conditions. In addition to reactor

pressure vessel internals, the piping systems of interest include the MS and FW piping and their attached piping systems (e.g., MS drain lines, electro-hydraulic control lines, relief valve vent lines, thermowells, sample probes). Discuss your evaluations of potential adverse flow effects on reactor pressure vessel internals, and MS and FW systems and components, from EPU operation; the results of your evaluations; and modifications planned or completed to avoid adverse flow effects from EPU operation. Describe your plan and schedule of the vibration monitoring program with regard to the power ascension, monitoring methods (installing accelerometers, using hand-held devices), strategic locations of monitoring, and acceptance criteria. Confirm whether the vibration monitoring will be performed for both MS and FW lines and branch lines piping and components in accordance with the ASME OM Code.

13. The application dated September 10, 2003 (Reference 1), Attachment 6, page 3-9, states that in Table 3-6, the allowable loads are compared to the applied loads for the CLTP and CPPU conditions for limiting shroud repair components. However, Table 3-6 (page 3-38) shows “VYNPS RIPDs for Faulted Conditions (psid).” Confirm that the correct reference should be Table 3-7 (page 3-39), “VYNPS Reactor Internal Components - Summary of Stresses.”

14. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 3.5, states that the MS and FW piping were evaluated for the EPU conditions. Provide a summary of results of analysis for both the current rated and the EPU conditions in comparison to the code allowable limits. On page 3-17 of Appendix 6, you indicated that some MS piping supports will be modified due to the increase in MS flow rate for the EPU. Provide the schedule for implementing the modifications of these supports. Confirm whether the EPU analysis for the MS piping reflect the modified piping configuration.

15. Regarding the application dated September 10, 2003 (Reference 1), Attachment 6, Section 3.5, provide a summary of the evaluation for the reactor recirculation piping and components for which the flow may increase to accommodate the increase in thermal power. Include recirculation pumps and valves and their supports, which may require a modification to support the EPU at VYNPS.

16. The application dated September 10, 2003 (Reference 1), Attachment 6, Table 3-7 and Section 3.3.2, qualitatively evaluates the reactor internal components such as top guide, fuel channel, steam dryer, feedwater sparger, jet pump, core spray line and sparger, and incore housing and guide tube, for the EPU conditions. Provide a quantitative evaluation by comparing the key parameters and design transients, loads and load combinations that are used in the design basis analysis report for stresses and CUFs in each component, against the EPU conditions. Confirm whether and how the design basis parameters envelop those of the CPPU condition.

17. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.1.2.3, states that under CPPU conditions, the blowdown flow rate would increase slightly due to the increase in subcooling in the water initially in the circulation loops. This section does not address the change of annulus pressurization due to the increase in steam and feedwater flow for the EPU conditions. Discuss the change of the annulus pressurization due to MS and FW line breaks while the steam and feedwater

flow rate will increase about 20% for the EPU operation. Confirm whether you considered the changes in annulus pressurization, jet impingement, pipe restraint loads or fuel lift loads in the analysis of the reactor vessel and internal components that are affected for normal, upset, emergency and faulted conditions as discussed on page 3-5.

Plant Support Branch (IPSB)

Quality and Maintenance Section (IPSB-A)
Reviewers: Robert Pettis, Kevin Coyne

1. The application dated September 10, 2003 (Reference 1), Attachment 7, provides the justification for exception to large transient testing (LTT). Discuss why LTT is not considered necessary in light of recent industry experience relative to steam dryer failures. Include in your response: (a) how operation at EPU conditions may be likely to cause high-cycle fatigue in safety-related plant components (e.g., due to high steam line flow rates); (b) how lessons-learned from the April 16, 2003, inadvertent opening of a power operated relief valve at QC2, and its role in the second steam dryer failure, may be affected by plant operation at EPU conditions; (c) the possibility that performing LTT may identify undetected latent flaws in plant components and equipment normally subjected to pre-EPU conditions; and (d) how information contained in GE Service Information Letter (SIL) No. 644 and NRC Information Notice 2002-26, were considered in the licensee's decision not to perform LTT.

License Renewal and Environmental Impacts Branch (RLEP)

Environmental Section (RLEP-C)
Reviewer: Stacey Imboden

1. Does Entergy have any protective measures to prevent aquatic species from entering the intake area on Vernon Pond?

2. What affect will the EPU have on the local tax base? Will the EPU result in increased tax revenues for Windham county, due to an increase in VYNPS value? Will the EPU lower the probability of early plant retirement? Please provide a short description of the benefits and disadvantages to the local community if the EPU was implemented.

3. What is the estimated dose to members of the public located offsite due to the projected 1.2% increase in the volume of liquid radioactive effluents following the EPU?

4. Describe any known or observed threatened or endangered species on the VYNPS site. Specifically address the following species known to occur in Windham County: Bald Eagle, Indiana Bat, and Northeastern Bulrush. Have any surveys or studies been conducted on these species?

Plant Systems Branch (SPLB)

Balance of Plant Section (SPLB-A)
Reviewer: Devender Reddy

1. General:

   Implementation of the proposed VYNPS EPU requires increased volumetric flow rates, which result in higher flow velocities in the existing piping systems for the CPPU conditions. Please provide the calculated flow velocities that will result due to the proposed EPU conditions, and compare them to the design criteria and industry guidelines for systems such as main steam and associated systems, condensate and feedwater system, and other balance-of-plant (BOP) systems that are affected. Also, discuss in detail any dynamic loading and water hammer affects that the EPU will have on system functional and design capabilities.

2. Flood Protection:

   The application dated September 10, 2003 (Reference 1), Attachment 6, Section10.1.2, states:

   > "The flooding is dependent upon the maximum water levels in the hotwells..... FW system changes have been evaluated and the flooding rate from a FW line break is acceptable."

   Supplement 4 (Reference 5), Attachment 6, MATRIX 5, Page 6, SE 2.5.1.1.1 VY NOTE, Flood Protection, states:

   > "The limiting flooding events at VYNPS, however, are not controlled by fluid volumes in tanks and vessels, but results from open cycle systems such as Service Water, Fire Water, and Circulating Water System."

   Please address the following:

   a) Explain the difference between the above two statements. What are the limiting flooding events at VYNPS that could affect the performance of structures, systems, and components (SSCs) at the CPPU conditions? Please provide justification and/or details of the VYNPS evaluation that concludes that the SSCs important to safety will continue to be protected from flooding and will continue to meet the requirements of draft General Design Criteria (GDC) 2 following implementation of the proposed EPU.

   b) Explain whether VYNPS performed calculations and/or analyses to evaluate the affects of fluid volumes in tanks and vessels on flooding. If so, are they based on the total volumes of the tanks and vessels or some lesser amount? If such analyses were not considered to be necessary, explain the basis for this conclusion.

3. Turbine-Generator and Internally Generated Missiles:

   The application dated September 10, 2003 (Reference 1), Attachment 6, Section 7.1, states that the high-pressure turbine has been redesigned with new rotor, diaphragms, and buckets to increase its flow passing capability. Please address the following:

   a) Explain the impact that these modifications will have on the existing turbine overspeed protection features and requirements, and how protection from turbine overspeed protection will continue to be assured.

   b) Explain why no changes are required for the turbine overspeed trip set-point.

   c) Explain why/how equipment important to safety will continue to be protected from the effects of turbine missiles

4. Turbine Gland Sealing System:

   With respect to Supplement 4 (Reference 5), Attachment 6, MATRIX 5, Page 8, SE 2.5.2.3 VY NOTE, Turbine Gland Sealing System, please provide the basis, with respect to safety considerations, for the VYNPS CPPU determination that the system is capable of performing its intended function without modification.

5. Main Steam Supply System (MSSS):

   With respect to Supplement 4 (Reference 5), Attachment 6, MATRIX 5, Page 9, SE 2.5.4.1 VY NOTE, Main Steam Supply System, please explain how the MSSS will continue to meet draft GDC-40 and draft GDC-42 following EPU implementation.

6. Turbine Bypass System:

   According to the Updated Final Safety Analysis Report (UFSAR), Section 11.5.2, “Power Generation Design Bases,” the main turbine bypass system shall have a capacity of 105% of the maximum expected turbine design flow. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 7.3, states that the turbine bypass valves were initially rated for a total steam flow capacity of not less that than 105% of the original rated reactor steam flow (i.e., 7.06 Mlb/hr). Whereas, at CPPU conditions, rated reactor steam flow is 7.906 Mlb/hr, resulting in a bypass capacity that is only 89% of the CPPU rated steam flow. Although the licensee concludes that the bypass capacity at VYNPS remains adequate for normal operational flexibility at CPPU conditions, this appears to be a change in the plant design and licensing basis which has not been specifically recognized and addressed in the submittal. Please explain this apparent discrepancy.

Probabilistic Safety Assessment Branch (SPSB)

Containment and Accident Dose Assessment Section (SPSB-C)
Reviewer: Richard Lobel

1. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, discuss the risk implications of relying on containment accident pressure for emergency core cooling system (ECCS) pump net positive suction head (NPSH) by addressing the following:

    a) Describe how the containment accident pressure credit impacts the probabilistic risk assessment (PRA) success criteria and accident sequence modeling. Identify which PRA accident sequences lead to core damage as a result of inadequate containment accident pressure.

    b) How is inadequate containment accident pressure modeled in the PRA? What failure mechanisms (e.g., equipment failures, operator errors, etc.) have been included? How have their probabilities been estimated?

    c) How much does inadequate containment accident pressure contribute to the overall core-damage frequency? Provide numerical results, including the Fussell-Vesely importance measures and the risk achievement worths (RAWs) for each basic event whose occurrence results in inadequate containment accident pressure.

    d) What core-damage frequency would result if the PRA took no credit for containment accident pressure?

2. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, what indications would be available to the operator during a loss-of-coolant accident (LOCA) which could indicate abnormal ECCS pump performance, especially cavitation due to inadequate NPSH? What actions would the operator take in response to indications of inadequate ECCS pump NPSH?

3. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, have reactor vessel isolation events been considered as possibly more limiting than long-term suppression pool heat up following a LOCA for ECCS pump available NPSH (i.e., reactor vessel isolation with high pressure coolant injection (HPCI) unavailable and automatic depressurization system (ADS) activated to proceed to safe shutdown)? When is suppression pool cooling initiated with respect to ADS actuation?

4. Licensee letter BVY 99-45 to the NRC dated March 31, 1999, discussed issues related to the suppression pool water temperature analysis for VYNPS. The letter states that the decay heat model has been found to be acceptably conservative when a 2-sigma uncertainty is applied. Provide clarification of how the 2-sigma uncertainty was applied with respect to the 2% thermal power uncertainty.

5. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, were the recommendations of SIL 636 Revision 1 (related to the determination of decay heat) used for the containment calculations and the ECCS pump NPSH calculations?

6. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, this section states that the debris loading on the suction strainers and the methodology used to calculate available ECCS NPSH for CPPU are the same as the pre-CPPU conditions. Please verify that there have been no changes since your December 29, 1999 letter to the NRC documenting your completion of the actions requested by NRC Bulletin 96-03. If changes have been made to the debris loading calculations, please describe these changes.

7. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, provide the value used for the residual heat removal (RHR) heat exchanger K value. Verify that no change was made in this value from that used in the current licensed thermal power (CLTP) licensing basis analysis. Please identify this CLTP analysis. Describe the testing done (type of test and frequency) to assure that this value remains bounding.

8. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, please supply figures of the pressure available and pressure required as a function of time for NPSH for anticipated transients without scram (ATWS), station blackout and Appendix R similar to Figure 4-6.

9. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, what flow rates are assumed for the ECCS pumps for the short-term and the long-term NPSH analyses? Page 4-10 discusses “expected” flow rates. How is it assured that the flow rate won’t be less than the assumed values?

10. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, what, if any, containment accident pressure would be required if a more realistic calculation of drywell and wetwell response to a LOCA was performed rather than the design basis analysis? For example, nominal reactor power, decay heat without the 2-sigma, realistic pump flows, credit for the effect of suppression pool temperature on required NPSH, best estimate RHR heat exchanger performance, no single failures, normal suppression pool water level, etc. The response to this question may be based on existing sensitivity studies or engineering judgment. The staff is not requesting a calculation.

11. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, list the conservatisms included in the calculation of available NPSH and containment accident pressure and the value of each conservatism in terms of suppression pool temperature or containment pressure.

12. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, what values of required NPSH are assumed for the ECCS pump for which containment accident pressure is required? Is one value used for each pump or is there a range of values for each pump? Verify that no temperature corrections are made to the required NPSH values.

13. The following questions pertain to the application dated September 10, 2003 (Reference 1), Attachment 6, Sections 10.5.3, 10.6, and 10.9. A normally open torus vent line must be closed to retain containment accident pressure for adequate available NPSH. The staff is not aware of this being necessary for other licensees with Mark I containments that have to rely on containment accident pressure for adequate available NPSH.

    a) Describe the configuration of the line the valve is in. Provide a drawing or sketch.

    b) Where does this line vent to?

    c) What is the normal function of this line?

    d) Is this valve a containment isolation valve?

    e) What automatic closure/open signals does the valve receive?

    f) What actions would the operator take if this valve does not close?

    g) What is the motive power for this valve? Verify that this motive power will be available for the LOCA, Appendix R fire, ATWS, and Station Blackout scenarios.

    h) What is the surveillance frequency for testing this valve, and what testing (stroke testing/leak testing) is required?

    i) Is there another (redundant) valve in the line which can be closed if this valve does not close when required?

    j) At what point in the accident sequence will the operator close this valve? Why is this time acceptable? What is the stroke time of this valve, and is this time accounted for in the determination of adequate available NPSH?

    k) What indications will the control room operator rely on to verify that the valve is closed? Will this indication be available during a LOCA, Appendix R fire, ATWS, or Station Blackout event?

14. The application dated September 10, 2003 (Reference 1), Attachment 6, Table 1-1, lists the computer codes used for CPPU. The NRC approved GOTHIC 5.0e for analyses performed for VYNPS Amendment 163. Table 1-1 states that GOTHIC 7.0 is being used for Appendix R fire protection analyses.

a) Please describe or provide a reference for the analyses and the assumptions used for these analyses.

b) The NRC issued a safety evaluation dated September 29, 2003 on the use of GOTHIC 7.0 for containment analyses for the Kewaunee Nuclear Power Plant, a Westinghouse-designed pressurized water reactor. Please verify that your use of GOTHIC 7.0 is consistent with the conditions specified in this safety evaluation.

c) Describe any other uses of GOTHIC 7.0 to support this power uprate.

d) Has an evaluation, in accordance with 10 CFR 50.59, been performed to evaluate whether NRC prior review and approval of the change from GOTHIC 5.e to GOTHIC 7.0 is necessary?

e) Has the guidance of Generic Letter (GL) 83-11 and GL 83-11 Supplement 1 been followed for the use of GOTHIC 7.0?

f) Describe any benchmarking done to support the use of GOTHIC 7.0.

15. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.1.1.1 (b), discusses an evaluation that was performed regarding the possibility of steam injestion into the ECCS suction strainers. Please provide this evaluation (Reference 26) for NRC review.

16. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.1.2.1, discusses LOCA loads. Explain why vent thrust loads are less than those calculated during the Mark I Containment Long Term Program.

17. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.1.2.3, discusses subcompartment pressurization. How was the estimate obtained that the effect of the increase in subcooling would be less than 3 psid on the resulting annulus pressure?

18. The application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.1.5, discusses a hardened wetwell vent system installed at VYNPS in response to GL 89-16. Is the hardened vent capability maintained without any changes in acceptance criteria or analytical methods?

19. The application dated September 10, 2003 (Reference 1), Attachment 6, Table 4-1, provides VYNPS containment performance results. Explain why the use of the CPPU method for the CLTP increases the peak drywell pressure by 3.4 psi and the peak drywell air space temperature by 3.7 °F. Page 4-4 says the Moody slip critical flow model was responsible for most of this increase. What critical flow model was used for the Mark I Long Term Program?

20. Verify that the primary containment long-term pressure and temperature responses have been determined using the five cooling conditions listed in Section 5.2.4.3 of the UFSAR.

21. Verify that the proposed EPU amendment is consistent with the guidance of Regulatory Guide (RG) 1.82 Revision 3. In addition, confirm that RG 1.82 Revision 3, or at least Section 2.1, will become part of the VYNPS licensing basis if the proposed amendment is approved.

22. Describe how the VYNPS emergency operating procedures will be revised to ensure that the containment accident pressure will be prevented from falling below the pressure required for adequate available NPSH.

23. The application dated September 10, 2003 (Reference 1), Attachment 6, Table 4-2 and Figure 4-6, show that the containment accident pressure requested for adequate available NPSH is 1.3 psig at 50 hours. When is containment accident pressure no longer required?

24. Does the higher temperature of the drywell air following a LOCA for the CPPU, compared to the calculated drywell air temperature of the CLTP, affect drywell bypass considerations in any way? Please explain.

25. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, the Hydraulic Institute recommends margin above the required NPSH to suppress cavitation. What margin is needed for the VYNPS pumps crediting containment accident pressure and how is this margin accounted for in the VYNPS NPSH calculations? Provide quantitative information.

26. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, please provide for NRC review the VYNPS calculations of NPSH and containment accident pressure associated with the EPU amendment request.

27. With respect to the application dated September 10, 2003 (Reference 1), Attachment 6, Section 4.2.6, provide the results of an analysis of the stuck open reactor vessel relief valve which demonstrates that adequate NPSH is available for successful operation of the ECCS pumps.

Reactor Systems Branch (SRXB)

Boiling Water Reactors and Nuclear Performance Section (SRXB-A)
Reviewer: Edward Kendrick

1. Supplement 4 (Reference 5) provides information as to the method used by the licensee to provide oversight of engineering products of GE Nuclear Engineering (GENE) and the licensee's confirmation process related to the GENE analyses. Attachment 1 cites two assessments performed by the licensee at GENE offices during May and October of 2003.

    a) Please describe the power uprate confirmation process used by VYNPS, citing documentation and references as appropriate.

    b) Please cite the reference for the GENE Quality Assurance Program (QAP) that was used for the VYNPS EPU safety analyses discussed in the power uprate safety analysis report (PUSAR). Is this QAP also applicable to work performed by Global Nuclear Fuel (GNF) and GE Energy Services (GEES)?

    c) Please cite the reference for the VYNPS QAP that was used for the EPU safety analyses oversight. Is this QAP also applicable to the VYNPS "control of off-site services process" that is cited.

    d) How are the assessments for the May and October 2003 trips documented, and where is this documentation available? Was there an audit plan, and how was the success of the assessment judged?

    e) The summary of the VYNPS confirmation mentions feedback to the GENE performers of comments and resolution. How is this documented? Will the final Design Record Files show the results of the resolution?

    f) Please provide further description of any additional assessments planned and the schedule for accomplishing them.

2. Supplement 4 (reference 5), Attachment 1, Item 1.c discusses dispositions of certain items that have not yet been confirmed since they will be evaluated for the uprated core prior to CPPU implementation. The VYNPS response to this issue, which was raised in the NRC's letter dated December 15, 2003, cites Section 1.1.1 of the GENE CPPU Licensing Topical Report (CLTR), the GENE PUSAR, and Section 1.5 of the NRC's Safety Evaluation for the CLTR, as justifying the assertion that no further analysis is required to be performed for the GENE PUSAR submittal, and that further review of the GNF standard reload analysis methods (GESTAR-II) or the analysis results is not necessary. However, the VYNPS response also notes that the reload licensing analysis (RLA) process is being treated as a design change, requiring formal review and approval of key inputs and output.

    a) Please describe the reload design change process being used, citing documentation and references as appropriate.

b) Please describe the VYNPS participation in the GNF reload design meetings that are cited. What were the dates and how and where are these meetings documented?

c) Please provide the current schedule for the Supplemental Reload Licensing Report and the Core Operating Limits Report.

3. The disposition of the draft GDC versus final GDC concern was addressed in Supplement 4 (Reference 5), Attachment 4, by providing a revised template SE based on the VYNPS current licensing basis. The revisions correctly note the differences in the draft GDC wording, including the draft use of “acceptable fuel damage limits” versus the final wording of “specified fuel design limits.” However, the acronym SAFDLs (specified acceptable fuel design limit(s)) still appears (Sections 2.8.5.3, 2.8.5.4 and 2.8.5.5 for example). Provide a revised template SE that is consistent with the draft GDC wording.

REFERENCES

1) Entergy letter (BVY 03-80) to NRC dated September 10, 2003, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Extended Power Uprate”

2) Entergy letter (BVY 03-90) to NRC dated October 1, 2003, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 1, Extended Power Uprate -Technical Review Guidance”

3) Entergy letter (BVY 03-95) to NRC dated October 28, 2003, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 2, Extended Power Uprate - Grid Impact Study”

4) Entergy letter (BVY 03-98) to NRC dated October 28, 2003, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 3, Extended Power Uprate - Updated Information”

5) Entergy letter (BVY 04-009) to NRC dated January 31, 2004, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 4, Extended Power Uprate - NRC Acceptance Review”

6) Entergy letter (BVY 04-008) to NRC dated January 31, 2004, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 5, Extended Power Uprate - Response to Request for Additional Information”

7) Entergy letter (BVY 04-025) to NRC dated March 4, 2004, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 6, Extended Power Uprate - Withholding Proprietary Information”

8) Entergy letter (BVY 04-050) to NRC dated May 19, 2004, “Vermont Yankee Nuclear Power Station, Technical Specification Proposed Change No. 263, Supplement No. 7, Extended Power Uprate - Confirmatory Results”